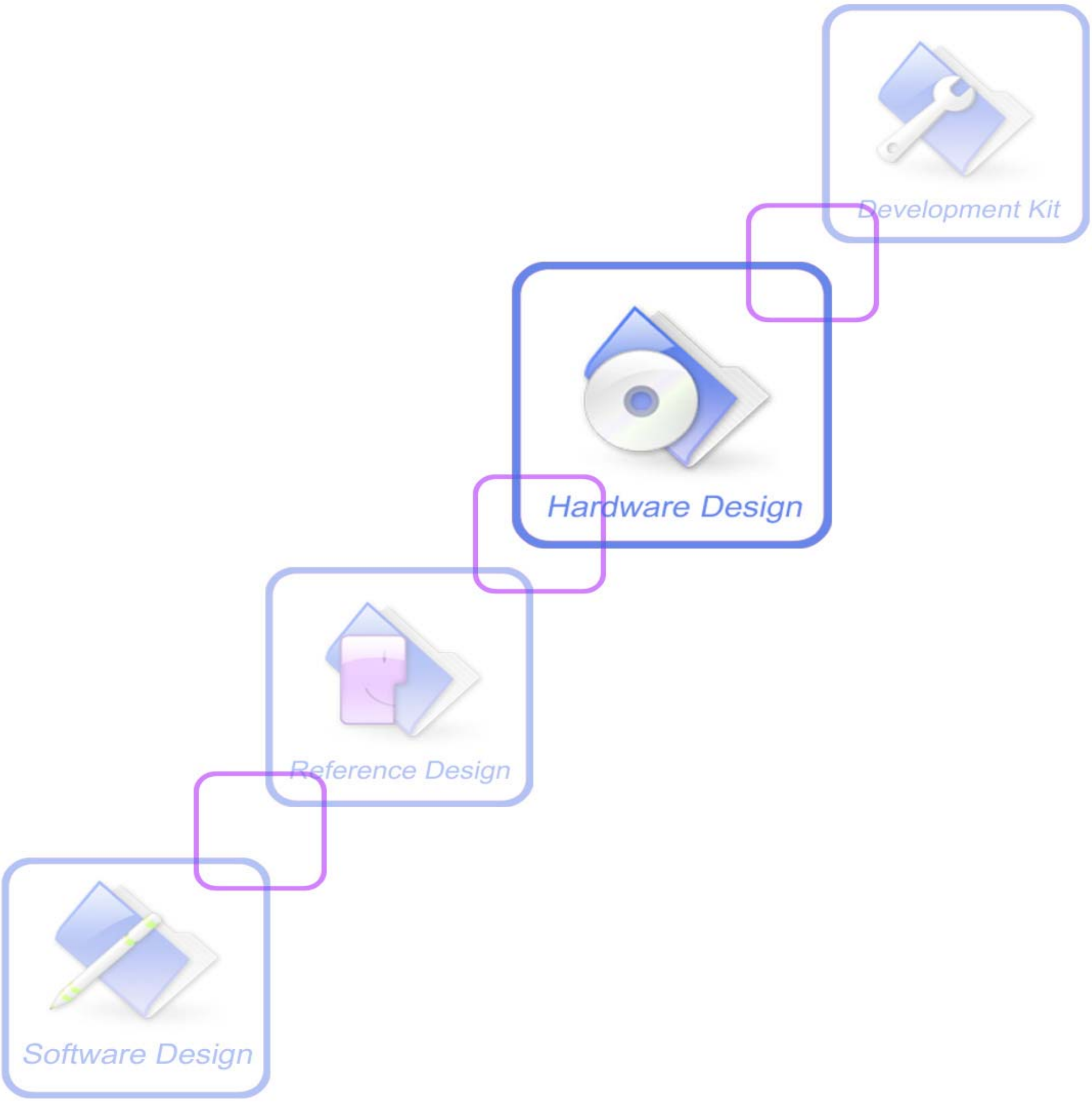
A company of SIM Tech

SIM900D_Hardware Design_V2.02



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Version History

Date	Version	Description of change	Author
2010-03-31	1.01	Origin	Jing.zhou
2010-04-09	1.02	Changed GHOST mode to Charge-only mode §3.4.1.1Update the Figure8: Timing of turn on system using PWRKEY §3.4.2.1Update the Figure9: Timing of turn off system using PWRKEY §4.2Update the Table25: SIM900D conducted RF receive sensitivity	Jing.zhou
2010-06-24	1.03	§3.8, Modify the VRTC pin connection when backup is not needed. §2.1, §3.3. §3.4 Modify the power supply range from 3.4V~4.5V to 3.1V~4.8V. §3.4.1.1Update the Figure8: Timing of turn on system using PWRKEY	Jing.zhou
2010-10-09	1.04	Modify the power supply range to 3.2V~4.8V. §3.3.2 Add Figure6: The minimal VBAT voltage at VBAT drop §3.4 Modified figure7，figure8，figure11. §3.6 Add 3.6.4 and 3.6.5 description. §3.11.1 Update the Figure25 §3.7 Update the Figure13	Jing.zhou
2011-04-01	2.00	Arrange the structure of document.	Jing.zhou
2012-02-23	2.01	Modify chapter6 Manufacturing	Juntao.zhao
2012-05-07	2.02	Add illustration of SIM900 module information and some notes in chapter 5. Modify §6 Add some notes in chapter 5.	Juntao.zhao

1 Introduction

This document describes SIM900D hardware interface in great detail.
This document can help user to quickly understand SIM900D interface specifications, electrical and mechanical details. With the help of this document and other SIM900D application notes, user guide, users can use SIM900D to design various applications quickly.

2 SIM900D Overview

Designed for global market, SIM900D is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900D features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 33*33*3mm, SIM900D can meet almost all the space requirements in user applications, such as M2M, smart phone, PDA, FWP, and other mobile devices.

SIM900D has 48 SMT pads, and provides all hardware interfaces between the module and customers' boards.

- Serial port and debug port can help user easily develop user's applications.
- Audio channel which includes two microphone inputs and two receiver outputs.
- Programmable general purpose input and output.
- The SPI display interface will give users the flexibility to develop customized applications.

SIM900D is designed with power saving technique so that the current consumption is as low as 1.0mA in sleep mode.

SIM900D integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications. For details about TCP/IP applications, please refer to *document [2]*.

2.1 SIM900D Key Features

Table 1: SIM900D key features

Feature	Implementation
Power supply	3.2V ~ 4.8V
Power saving	Typical power consumption in sleep mode is 1.0mA (BS-PA-MFRMS=9)
Frequency bands	● SIM900D Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900.

	SIM900D can search the 4 frequency bands automatically. The frequency bands also can be set by AT command "AT+CBAND". For details, please refer to *document [1]*. ● Compliant to GSM Phase 2/2+
Transmitting power	● Class 4 (2W) at GSM 850 and EGSM 900 ● Class 1 (1W) at DCS 1800 and PCS 1900
GPRS connectivity	● GPRS multi-slot class 10（default） ● GPRS multi-slot class 8 (option)
Temperature range	● Normal operation: -30°C ~ +80°C ● Restricted operation: -40°C ~ -30°C and +80 °C ~ +85°C* ● Storage temperature -45°C ~ +90°C
Data GPRS	● GPRS data downlink transfer: max. 85.6 kbps ● GPRS data uplink transfer: max. 42.8 kbps ● Coding scheme: CS-1, CS-2, CS-3 and CS-4 ● Integrate the TCP/IP protocol. ● Support Packet Broadcast Control Channel (PBCCH)
CSD	● Support CSD transmission
USSD	● Unstructured Supplementary Services Data (USSD) support
SMS	● MT, MO, CB, Text and PDU mode ● SMS storage: SIM card
FAX	Group 3 Class 1
SIM interface	Support SIM card: 1.8V, 3V
External antenna	Antenna pad
Audio features	Speech codec modes: ● Half Rate (ETS 06.20) ● Full Rate (ETS 06.10) ● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) ● Adaptive multi rate (AMR) ● Echo Cancellation ● Noise Suppression
Serial port and debug port	**Serial port:** ● Full modem interface with status and control lines, unbalanced, asynchronous. ● 1200bps to 115200bps. ● Can be used for AT commands or data stream. ● Support RTS/CTS hardware handshake and software ON/OFF flow control. ● Multiplex ability according to GSM 07.10 Multiplexer Protocol. ● Autobauding supports baud rate from 1200 bps to 57600bps. **Debug port:** ● Null modem interface DBG_TXD and DBG_RXD. ● Can be used for debugging and upgrading firmware.
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM application toolkit	GSM 11.14 Release 99
Real time clock	Support RTC
Physical characteristics	Size: 33*33*3mm Weight: 6.2g

Firmware upgrade	Firmware upgradeable by debug port.

*SIM900D does work at this temperature, but some radio frequency characteristics may deviate from the GSM specification.

Table 2: Coding schemes and maximum net data rates over air interface

Coding scheme	1 timeslot	2 timeslot	4 timeslot
CS-1	9.05kbps	18.1kbps	36.2kbps
CS-2	13.4kbps	26.8kbps	53.6kbps
CS-3	15.6kbps	31.2kbps	62.4kbps
CS-4	21.4kbps	42.8kbps	85.6kbps

2.2 Operating Modes

The table below summarizes the various operating modes of SIM900D.

Table 3: Overview of operating modes

Mode	Function	
Normal operation	GSM/GPRS SLEEP	Module will automatically go into sleep mode if the conditions of sleep mode are enabling and there is no on air and no hardware interrupt (such as GPIO interrupt or data on serial port). In this case, the current consumption of module will reduce to the minimal level. In sleep mode, the module can still receive paging message and SMS.
	GSM IDLE	Software is active. Module registered to the GSM network, and the module is ready to communicate.
	GSM TALK	Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.
	GPRS STANDBY	Module is ready for GPRS data transfer, but no data is currently sent or received. In this case, power consumption depends on network settings and GPRS configuration.
	GPRS DATA	There is GPRS data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level); uplink/downlink data rates and GPRS configuration (e.g. used multi-slot settings).
Power down	Normal power down by sending the AT command "AT+CPOWD=1" or using the PWRKEY. The power management unit shuts down the power supply for the baseband part of the module, and only the power supply for the RTC is remained. Software is not active. The serial port is not accessible. Power supply (connected to VBAT) remains applied.	
Minimum	AT command "AT+CFUN" can be used to set the module to a minimum functionality mode	

functionality mode	without removing the power supply. In this mode, the RF part of the module will not work or the SIM card will not be accessible, or both RF part and SIM card will be closed, and the serial port is still accessible. The power consumption in this mode is lower than normal mode.
Charge-only mode	The module will systematically enter Charge-only mode when a charger and battery are connected to a switched-off SIM900D. In the mode, the module does not search for network and has limited AT commands available. The module also can enter Charge-only mode from Charge mode during normal operation by normally shutdown the module.
Charge mode during normal operation	The module will automatically go to this mode when a charger is connected to a Normal operation mode module of which battery voltage is not lower than 3.2V. Normal operation mode includes: SLEEP, IDLE, TALK, GPRS IDLE and GPRS DATA.

2.3 SIM900D Functional Diagram

The following figure shows a functional diagram of SIM900D:

- The GSM baseband engine
- Flash
- The GSM radio frequency part
- The antenna interface
- The other interfaces

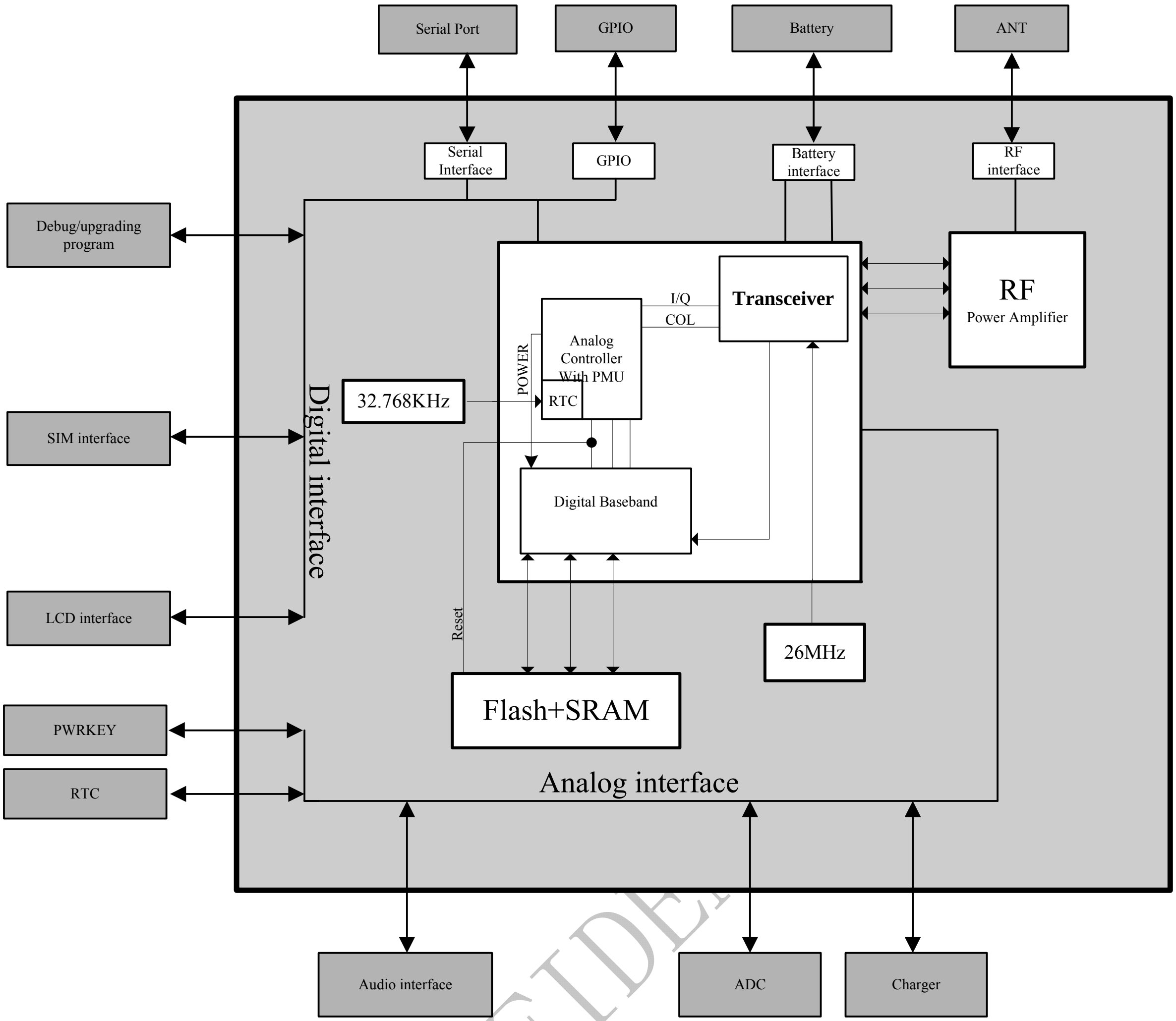


Figure 1: SIM900D functional diagram

3 Package Information

3.1 Pin out Diagram

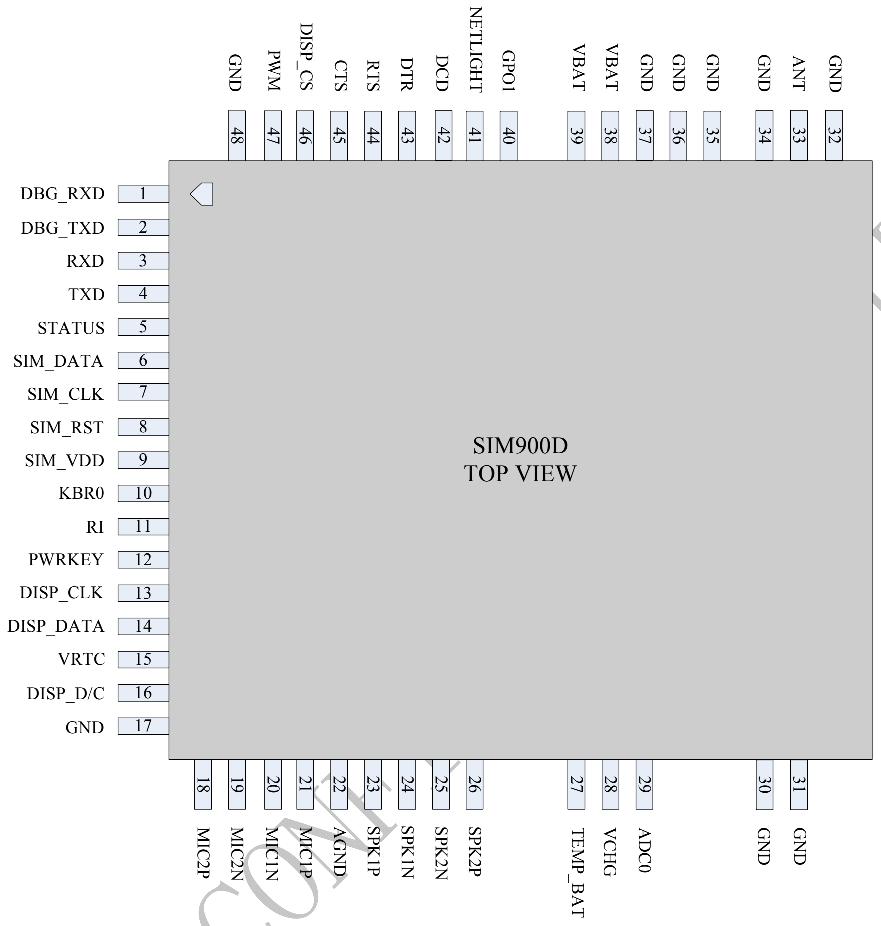


Figure 2: SIM900D pin out diagram (Top view)

3.2 Pin Description

Table 4: Pin description

Pin name	Pin number	I/O	Description	Comment
Power supply				
VBAT	38,39	I	Power supply	
VRTC	15	I/O	Power supply for RTC	It is recommended to connect with a battery or a capacitor (e.g. 4.7uF).
AGND	22		Analog GND	
GND	17,30,31,32, 34,35,36,37, 48		Ground	
Power on/down				
PWRKEY	12	I	PWRKEY should be pulled low at least 1 second and then released to power on/down the module.	Pulled up internally.
Audio interfaces				
MIC1P	21	I	Differential audio input	If these pins are unused, keep open.
MIC1N	20			
SPK1P	23	O	Differential audio output	
SPK1N	24			
MIC2P	18	I	Differential audio input	
MIC2N	19			
SPK2P	26	O	Differential audio output	
SPK2N	25			
Status				
STATUS	5	O	Power on status	If these pins are unused, keep open.
NETLIGHT	41	O	Network status	
LCD interface				
DISP _CLK	13	O	Display interface	If these pins are unused, keep open.
DISP_DATA	14	I/O		
DISP _D/C	16	O		
DISP _CS	46	O		
GPIOs				
GPO1	40	I/O	GPIO	If these pins are unused, keep open.
KBR0	10		GPIO	
Serial port				
RXD	3	I	Receive data	This pin should be pulled up to 3V externally.
TXD	4	O	Transmit data	If these pins are unused,

RTS	44	I	Request to send	keep open.
CTS	45	O	Clear to send	
DCD	42	O	Data carrier detect	
RI	11	O	Ring indicator	
DTR	43	I	Data terminal ready	
Debug interface				
DBG_TXD	2	O	For debugging and upgrading firmware	If these pins are unused, keep open.
DBG_RXD	1	I		
SIM interface				
SIM_VDD	9	O	Voltage supply for SIM card. Support 1.8V or 3V SIM card	All signals of SIM interface should be protected against ESD with a TVS diode array.
SIM_DATA	6	I/O	SIM data input/output	
SIM_CLK	7	O	SIM clock	
SIM_RST	8	O	SIM reset	
ADC				
ADC0	29	I	Input voltage range: 0V ~ 2.8V	If it is unused, keep open.
Pulse width modulation(PWM)				
PWM	47	O	PWM	If these pins are unused, keep open.
RF interface				
ANT	33	I/O	Radio antenna connection	Impendence must be controlled to 50Ω.
Charging				
VCHG	28	I	Charger input	These pins should be kept open.
TEMP_BAT	27	I	Battery temperature sensor	If it is unused, keep open.

3.3 Package Dimensions

Following shows the Mechanical dimensions of SIM900D (top view, side view and bottom view).

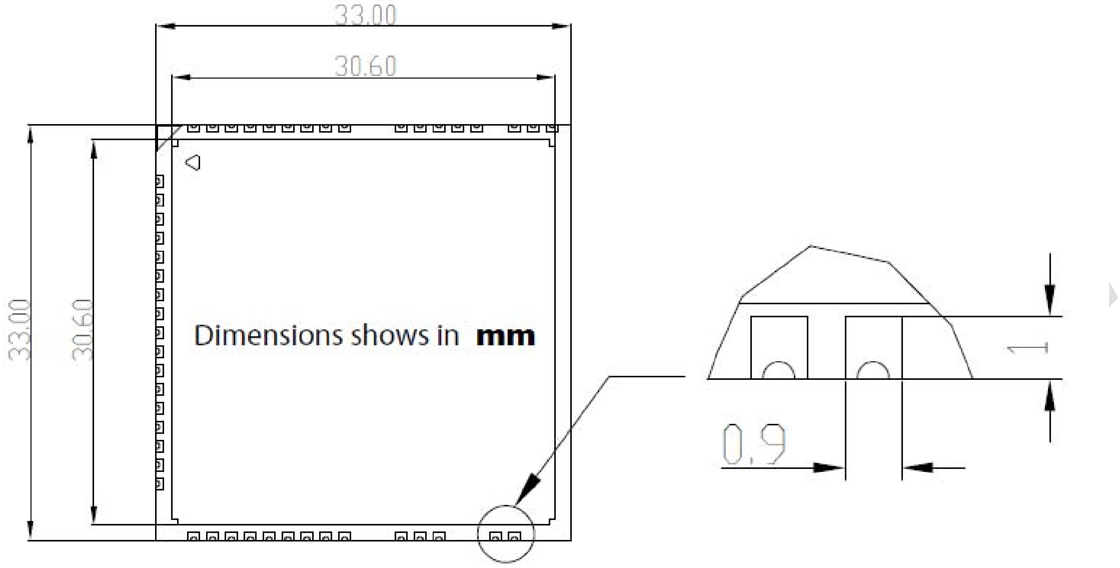


Figure 3: SIM900D top mechanical dimensions (Unit: mm)

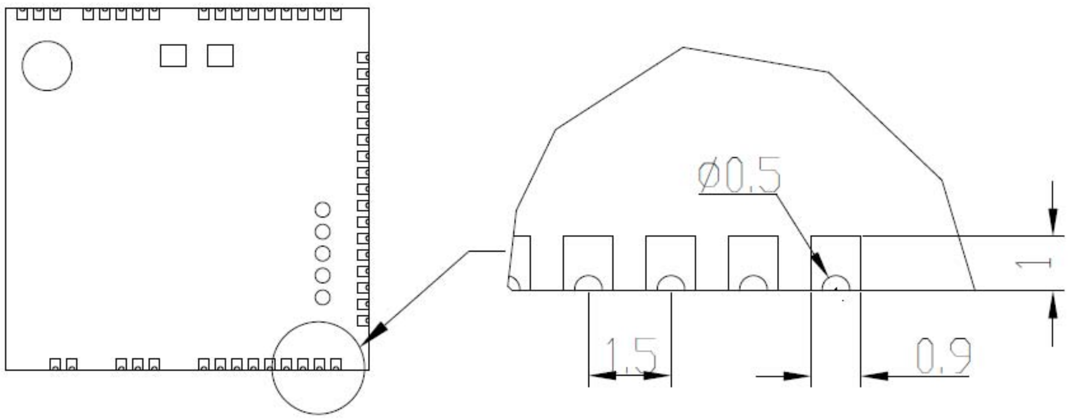


Figure 4: SIM900D bottom mechanical dimensions (Unit: mm)

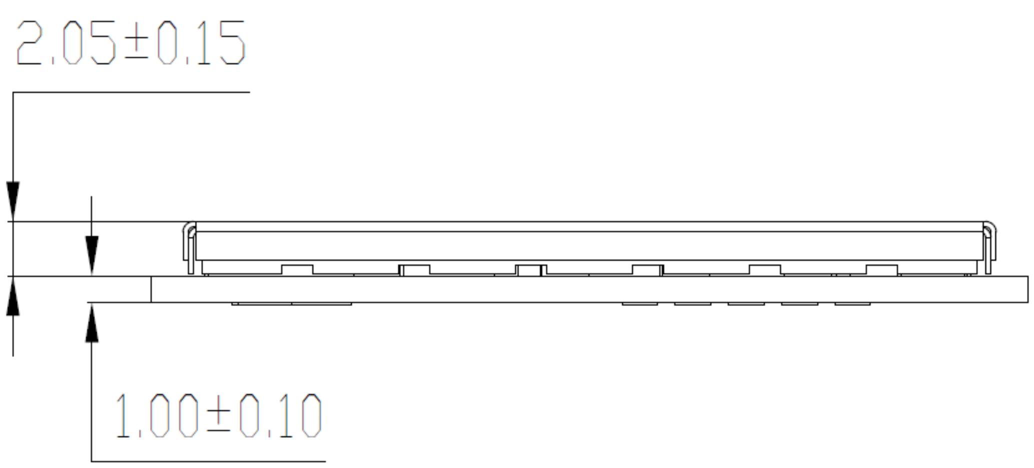


Figure 5: SIM900D side mechanical dimensions (Unit: mm)

FOOT PRINT RECOMMENDATION:

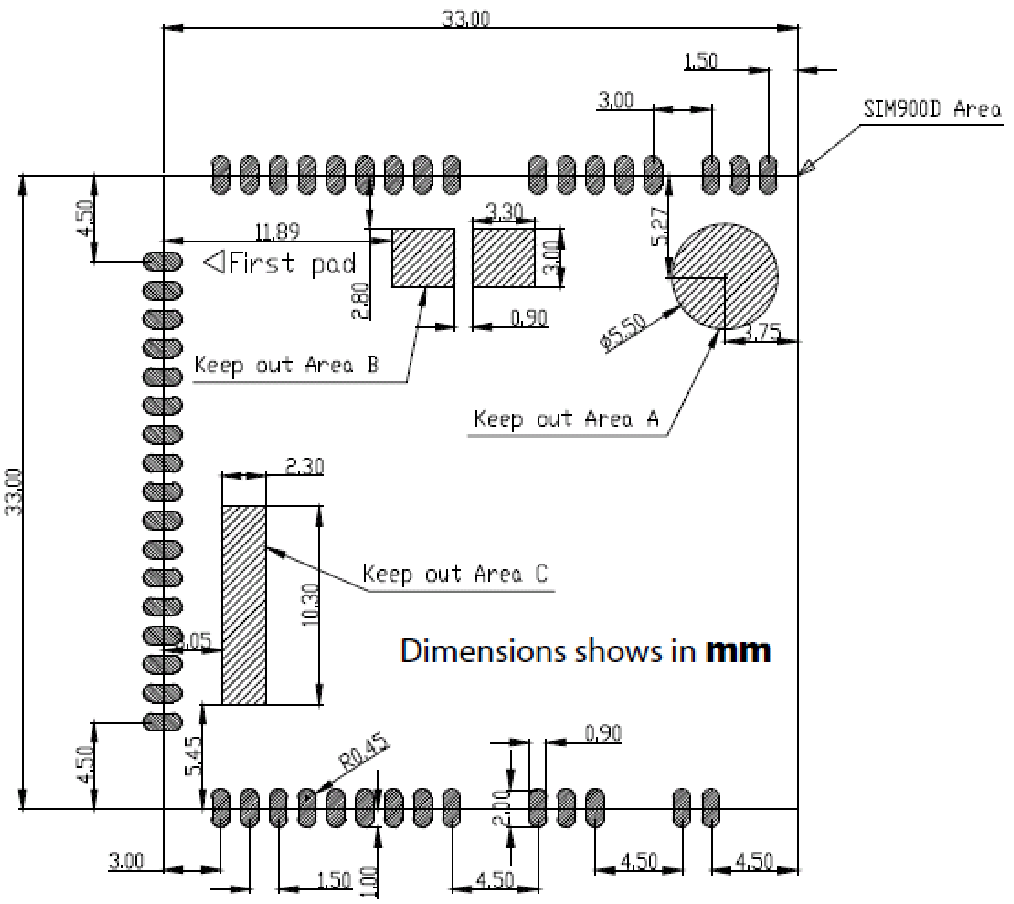


Figure 6: Recommended PCB decal (Unit: mm)

Note: Keep copper out of area A,B,C. Do not place via in area A, B and C to avoid short circuit between via on customer board and the test points on the bottom side of the module.

4 Application Interface

4.1 Power Supply

The power supply range of SIM900D is from 3.2V to 4.8V. The transmitting burst will cause voltage drop and the power supply must be able to provide sufficient current up to 2A. For the VBAT input, a bypass capacitor (low ESR) such as a 100 µF is strongly recommended; this capacitor should be placed as close as possible to SIM900D VBAT pins. The following figure is the reference design of +5V input power supply. The designed output for the power supply is 4.1V, thus a linear regulator can be used.

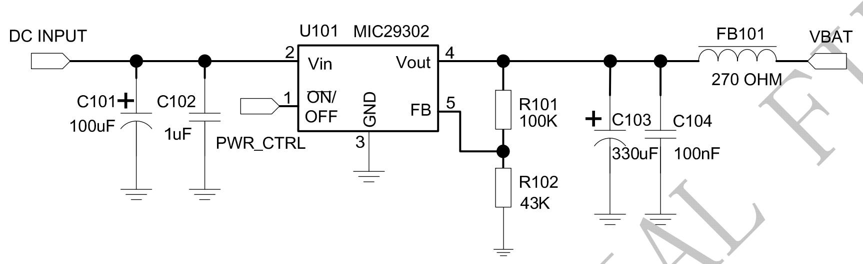


Figure 7: Reference circuit of the LDO power supply

If there is a high drop-out between the input and the desired output (VBAT), a DC-DC power supply will be preferable because of its better efficiency especially with the 2A peak current in burst mode of the module. The following figure is the reference circuit.

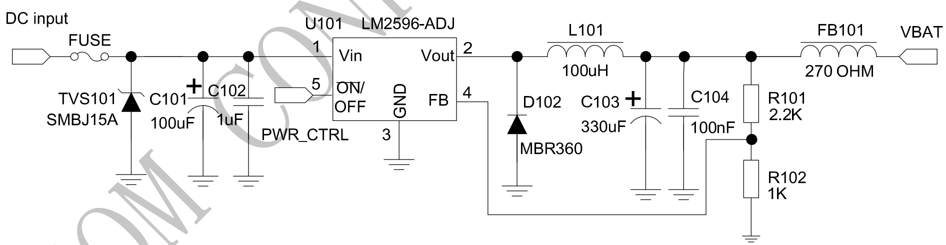


Figure 8: Reference circuit of the DC-DC power supply

The single 3.6V Li-ion cell battery can be connected to SIM900D VBAT pins directly. But the Ni-Cd or Ni-MH battery must be used carefully, since their maximum voltage can rise over the absolute maximum voltage of the module and damage it.

When battery is used, the total impedance between battery and VBAT pins should be less than 150mΩ.
The following figure shows the VBAT voltage drop at the maximum power transmit phase, and the test condition is as following:

VBAT=4.0V,

A VBAT bypass capacitor C_A=100µF tantalum capacitor (ESR=0.7Ω),

Another VBAT bypass capacitor C_B=1µF.

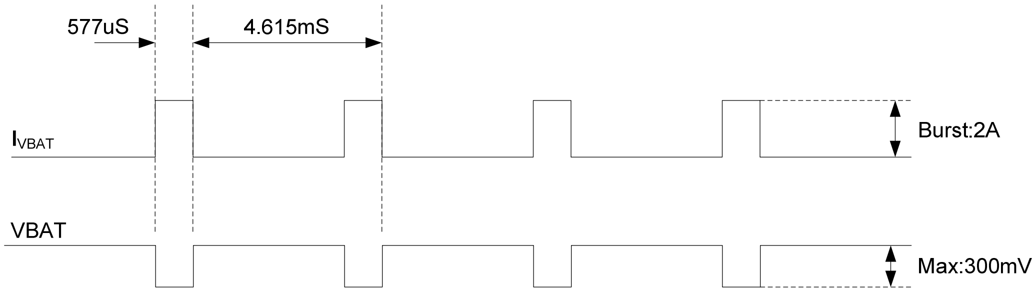


Figure 9: VBAT voltage drop during transmit burst

4.1.1 Minimizing Voltage Drop of VBAT

When designing the power supply in user's application, pay special attention to power losses. Ensure that the input voltage never drops below 3.1V even when current consumption rises to 2A in the transmit burst. If the power voltage drops below 3.1V, the module may be shut down automatically. The PCB traces from the VBAT pins to the power supply must be wide enough (at least 60mil) to decrease voltage drops in the transmit burst. The power IC and the bypass capacitor should be placed to the module as close as possible.

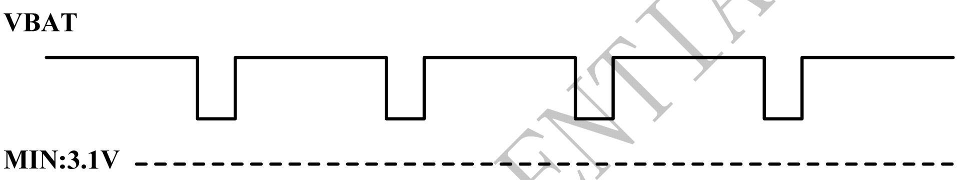


Figure 10: The minimal VBAT voltage requirement at VBAT drop

4.1.2 Monitoring Power Supply

The AT command "AT+CBC" can be used to monitor the VBAT voltage. For detail, please refer to *document [1]*.

4.2 Power on/down Scenarios

4.2.1 Power on SIM900D

4.2.1.1 Turn on SIM900D Using the PWRKEY Pin (Power on)

User can power on SIM900D by pulling down the PWRKEY pin for at least 1 second and release. This pin is already pulled up to 3V in the module internal, so external pull up is not necessary. Reference circuit is shown as below.

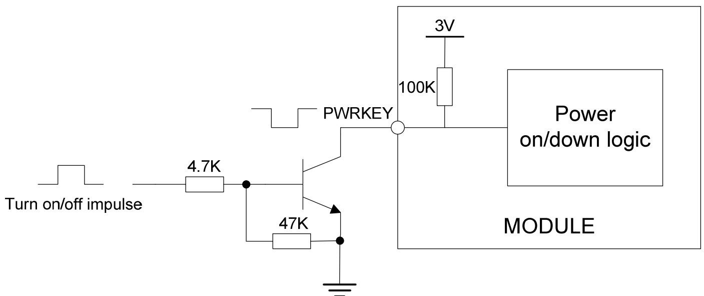


Figure 11: Powered on/down module using transistor

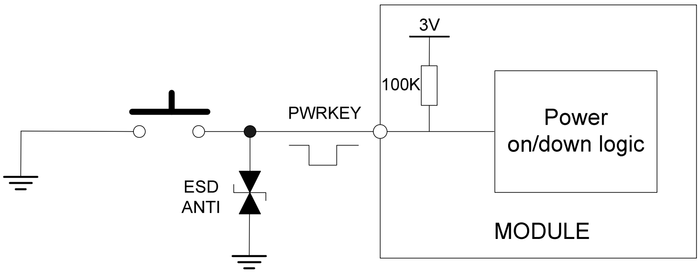


Figure 12: Powered on/down module using button

The power on scenarios is illustrated as following figure.

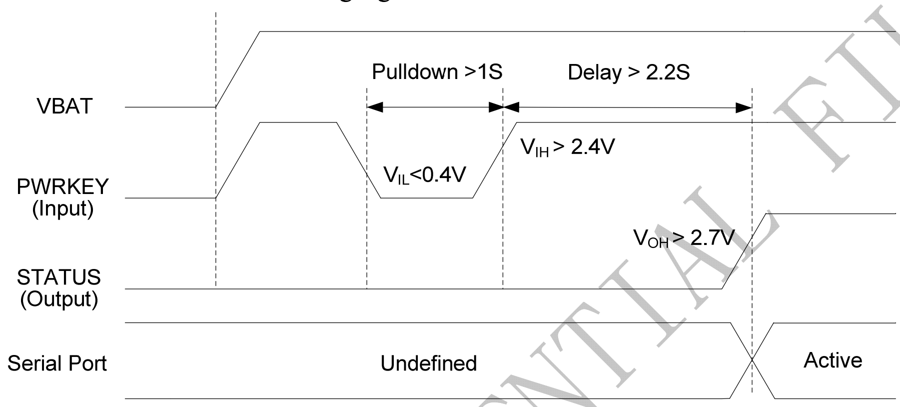


Figure 13: Timing of power on module

When power on procedure is completed, SIM900D will send following URC to indicate that the module is ready to operate at fixed baud rate.

RDY

This URC does not appear when autobauding function is active.

Note: User can use AT command "AT+IPR=x" to set a fixed baud rate and save the configuration to non-volatile flash memory. After the configuration is saved as fixed baud rate, the Code "RDY" should be received from the serial port every time when SIM900D is powered on. For details, please refer to the chapter "AT+IPR" in document [1].

4.2.1.2 Turn on the SIM900D using the VCHG signal

The SIM900D will be automatically turned on when a charger is connected to the switched-off SIM900D of which VBAT pin voltage is greater than 3.2V. SIM900D will go into the Charge-only Mode. In this mode, the module does not register to the network, and has only a few AT commands available. For detailed information please refer to chapter 3.5.

When module is powered on using the VCHG signal, SIM900D sends out result code as following when fixed baud rate set:

RDY

CHARGE-ONLY MODE

When user drives the PWRKEY of Charge-only mode SIM900D to a low level voltage for a period of time

(please refer to ***Figure 13 Timing of power on module***), the SIM900D will power up and go into Charge mode during normal operation. In this case, SIM900D sends out result code as following:

From CHARGE-ONLY MODE to NORMAL MODE

In Charge mode during normal operation, all operations and AT commands are available.

4.2.2 Power down SIM900D

SIM900D will be powered down in the following situations:

- Normal power down procedure: power down SIM900D by the PWRKEY pin.
- Normal power down procedure: power down SIM900D by AT command “AT+CPOWD=1”.
- Abnormal power down: over-voltage or under-voltage automatic power down.
- Abnormal power down: over-temperature or under-temperature automatic power down.

4.2.2.1 Power down SIM900D by the PWRKEY Pin

User can power down SIM900D by pulling down the PWRKEY pin for at least 1 second and release. Please refer to the power on circuit. The power down scenario is illustrated in following figure.

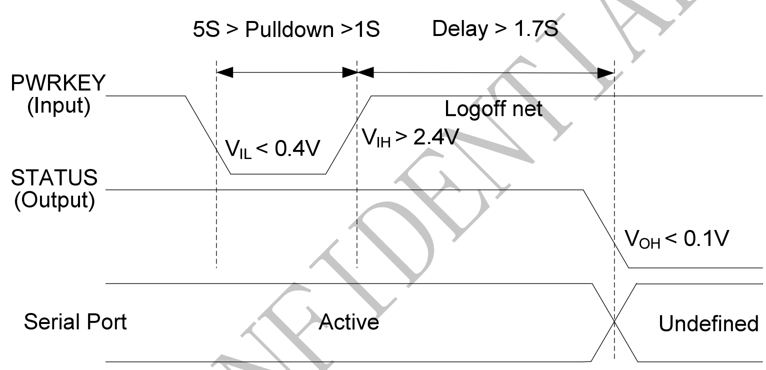


Figure 14: Timing of power down SIM900D by PWRKEY

This procedure makes the module log off from the network and allows the software to enter into a secure state to save data before completely shut down.

Before the completion of the power down procedure, the module will send URC:

NORMAL POWER DOWN

At this moment, AT commands can not be executed any more, and only the RTC is still active. Power down mode can also be indicated by STATUS pin, which is at low level at this time.

4.2.2.2 Power down SIM900D by AT Command

SIM900D can be powered down by AT command “AT+CPOWD=1”. This procedure makes the module log off from the network and allows the software to enter into a secure state to save data before completely shut down.

Before the completion of the power down procedure, the module will send URC:

NORMAL POWER DOWN

At this moment, AT commands can not be executed any more, and only the RTC is still active. Power down mode can also be indicated by STATUS pin, which is at low level at this time.

For detail about the AT command “AT+CPOWD”, please refer to *document [1]*

4.2.2.3 Over-voltage or Under-voltage Power down

The module software monitors the VBAT voltage constantly.
If the voltage ≤ 3.3V, the following URC will be reported:

UNDER-VOLTAGE WARNNING

If the voltage ≥ 4.7V, the following URC will be reported:

OVER-VOLTAGE WARNNING

If the voltage < 3.2V, the following URC will be reported, and the module will be automatically powered down.

UNDER-VOLTAGE POWER DOWN

If the voltage > 4.8V, the following URC will be reported, and the module will be automatically powered down.

OVER-VOLTAGE POWER DOWN

At this moment, AT commands can not be executed any more, and only the RTC is still active. Power down mode can also be indicated by STATUS pin, which is at low level at this time.

4.2.2.4 Over-temperature or Under-temperature Power down

The module will constantly monitor the temperature of the module,
If the temperature > +80℃, the following URC will be reported:

+CMTE: 1

If the temperature < -30℃, the following URC will be reported:

+CMTE:-1

If the temperature > +85℃, the following URC will be reported, and the module will be automatically powered down.

+CMTE: 2

If the temperature < -40℃, the following URC will be reported, and the module will be automatically powered down.

+CMTE:-2

At this moment, AT commands can not be executed any more, and only the RTC is still active. Power down mode can also be indicated by STATUS pin, which is at low level at this time.

The AT command “AT+CMTE” could be used to read the temperature when the module is running.
For details please refer to *document [1]*.

4.2.3 Restart SIM900D by PWRKEY Pin

When the module works normally, if the user wants to restart the module, follow the procedure below:

1) Power down the module.
2) Wait for at least 800mS after STATUS pin changed to low level.
3) Power on the module.

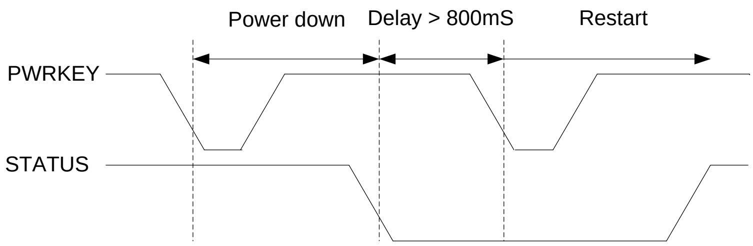


Figure 15: Timing of restart SIM900D

4.3 Power Saving Mode

SIM900D have two sleep modes: sleep mode 1 is enabled by hardware pin DTR; sleep mode 2 is only enabled by serial port regardless of the DTR. In sleep mode, the current of module is very low. The AT command "AT+CFUN=<fun>" can be used to set SIM900D into minimum functionality. When SIM900D is in sleep mode and minimum functionality, the current of module is lowest.

4.3.1 Minimum Functionality Mode

There are three functionality modes, which could be set by the AT command "AT+CFUN=<fun>". The command provides the choice of the functionality levels <fun>=0,1,4.

- 0: minimum functionality.
- 1: full functionality (default).
- 4: flight mode (disable RF function).

Minimum functionality mode minimizes the current consumption to the lowest level. If SIM900D is set to minimum functionality by "AT+CFUN=0", the RF function and SIM card function will be disabled. In this case, the serial port is still accessible, but all AT commands correlative with RF function and SIM card function will not be accessible.

For detailed information about the AT Command "AT+CFUN=<fun>", please refer to *document [1]*.

Table 5:The Current consumption of Minimum Functionality Mode

<fun>	Current consumption(uA) (sleep mode)
0	897
1	1306
4	967

4.3.2 Sleep Mode 1 (AT+CSCLK=1)

User can control SIM900D module to enter or exit the sleep mode 1 (AT+CSCLK=1) by DTR signal. When DTR is in high level and without interrupt (on air and hardware such as GPIO interrupt or data in serial port), SIM900D will enter sleep mode 1 automatically. In this mode, SIM900D can still receive paging or SMS from network but the serial port is not accessible.

Note: For SIM900D, it requests to set AT command "AT+CSCLK=1" and ensure DTR at high level to enable the sleep mode 1; the default value is 0, which can not make the module to enter sleep mode. For more details please refer to document [1].

4.3.3 Wake Up SIM900D from Sleep Mode 1 (AT+CSCLK=1)

When SIM900D is in sleep mode 1 (AT+CSCLK=1), the following methods can wake up the module:

- Pull down DTR pin.
  The serial port will be active after DTR pin is pulled to low level for about 50ms.
- Receive a voice or data call from network.
- Receive a SMS from network.

4.3.4 Sleep Mode 2 (AT+CSCLK=2)

In this mode, SIM900D will continuously monitor the serial port data signal. When there is no data transfer over 5 seconds on the RXD signal and there is no on air and hardware interrupts (such as GPIO interrupt), SIM900D will enter sleep mode 2 automatically. In this mode, SIM900D can still receive paging or SMS from network but the serial port is not accessible.

Note: For SIM900D, It is requested to set AT command "AT+CSCLK=2" to enable the sleep mode 2; the default value is 0, which can not make the module to enter sleep mode. For more details please refer to document [1].

4.3.5 Wake Up SIM900D from Sleep Mode 2 (AT+CSCLK=2)

When SIM900D is in sleep mode 2 (AT+CSCLK=2), the following methods can wake up the module:

- Send data to SIM900D via main serial port.*
- Receive a voice or data call from network.
- Receive a SMS from network.

- ***Note: The first byte of the user's data will not be recognized.***

4.4 Charging interface

SIM900D has integrated a charging circuit inside the module for Li-Ion batteries charging control, which make it very convenient for applications which support battery charging. A common connection is shown in the following figure:

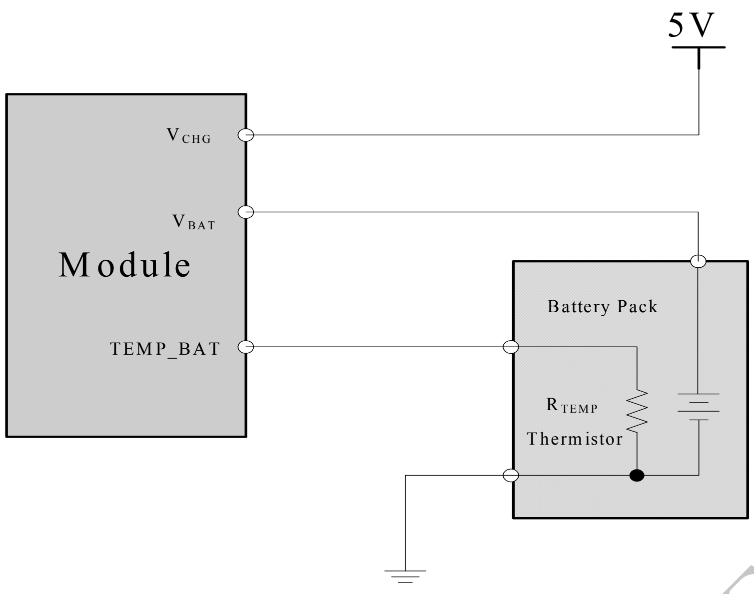


Figure 16: SIM900D with battery charger and pack connection

Battery temperature measurement is a customization function which is supported by the software in the module. In above figure, the R_{TEMP} is a NTC thermistor, MURATA NCP15XH103F03RC is recommended to use. Its impedance is 10Kohm at 25℃. Please refer to the above figure for the reference circuit.

4.4.1 Battery pack characteristics

SIM900D has optimized the charging algorithm for the Li-Ion battery that meets the characteristics listed below.

- The maximum charging voltage of the Li-Ion battery pack is 4.2V and the recommended capacity is 1100mAh. The Battery packs with more than 1100 mAh capacity will cost more time for charging.
- The pack should have a protection circuit to avoid overcharging, deep discharging and over-current, and the circuit should be insensitive to pulsed current.
- The internal resistance of the battery pack including protection circuit should be as low as possible. Its recommended value does not exceed 150mΩ.
- The battery pack must be protected from reverse pole connection.

It is recommended that the battery pack user integrated into the application is compliant with these specifications. The battery pack compliant with these specifications is also important for the AT command “AT+CBC”, 1-100 percent of remaining battery capacity returned by “AT+CBC” is related to battery capacity.

On the SIM900D, the build-in circuit of the power management chipset monitors the supply voltage constantly. Once the Under-voltage is detected, the SIM900D will be powered down automatically.

4.4.2 Recommended battery pack

Following is the specification of recommended battery pack:

Table 6: Specification of recommended battery pack

Items	Description
Battery type	Li-ion
Manufacturer	Jiade Energy Technology
Normal voltage	3.7V
Capacity	NORMAL 1100mAh
Charge Voltage	4.200±0.050V
Max Charge Current	1.0C
Charge Method	CC / CV (Constant Current / Constant Voltage)
Max Discharge Current	1.0C (for continuous discharging mode)
Discharge Cut-off Voltage	3.0V/ cell
Internal resistance	Initial≤130mΩ

4.4.3 Implemented charging technique

SIM900D has battery charging function. There are three pins related to the battery charging function: VCHG, VBAT and TEMP_BAT/ADC0 pins. The VCHG Pin is driven by an external voltage, system can use this Pin to detect a charger supply and provide most charging current through SIM900D module to battery when charging is in fast charge state. The VBAT gives out charging current from SIM900D module to external battery. TEMP_BAT Pin is for user to measure the battery temperature. Just let this Pin open if battery temperature measurement is not your concern.

So it is very simple to implement charging technique, user just needs to connect the charger to the VCHG Pin and connect the battery to the VBAT Pin.
SIM900D battery charging happens after detecting charger supply and the battery present. If there is no charger supply or no battery present, charging will not be enabled.

Normally, there are three main states in whole charging procedure.

- DDLO charge (Pull-up mode) and UVLO charge (Pre-charge mode);
- Fast charge;

DDLO charge and UVLO charge:
DDLO is the state of battery when its voltage is under 1.5V. And UVLO means the battery voltage less than 3.3V and more than 1.5V. The battery is not suitable for fast charging when its condition is DDLO or UVLO. The SIM900D provides a small constant current to the battery when the battery is between DDLO and UVLO. In DDLO charging, SIM900D gives out 1mA current to the battery. And in UVLO charging, SIM900D provides about less than 200mA current to the battery.

DDLO charging terminates when the battery voltage reaches 1.5V. UVLO charging terminates when the battery voltage is up to 3.3V. Both DDLO and UVLO charge are controlled by the SIM900D hardware only.

Fast charge:
If there is a charger supply and battery present and the battery is not in DDLO and UVLO, SIM900D will enter fast charge state. Fast charge is controlled by the software to make the current/voltage regulation. The charging scheme for the Li-Ion battery is constant current (about 550mA) first, followed by constant voltage charging once

4.2V is reached. Charging is stopped when the charging current at constant voltage has decreased down to the pre-set current.

4.4.4 Operating modes during charging

The battery can be charged during various operating mode. That means that charging can be in progress while SIM900D is in Normal mode (SLEEP, IDLE, TALK, GPRS IDLE or GPRS DATA mode). In this case the voltage supply should be sufficient. Here Charging in Normal mode is named as Charge mode.

If the charger is connects to the module's VCHG Pin and the battery is connected to the VBAT Pin while SIM900D is in POWER DOWN mode, SIM900D will go into the Charge-only Mode .

The following table gives the difference between Charge mode and Charge-only mode：

Table 7: Charge operating modes

	How to activate mode	Features
Charge Mode	Connect charger to module's VCHG Pin and connect battery to VBAT Pin of module while SIM900D is in Normal operating mode, including: IDLE, TALK mode; SLEEP mode etc;	● GSM remains operational and registers GSM network while charging is in progress; ● The serial interfaces are available in IDLE, TALK mode, the AT command set can be used fully in this case; In SLEEP mode, the serial interfaces are not available. Once the serial port is connected and there is data in transfer. SIM900D will exit the SLEEP mode.
Charge-only Mode	Connect charger to module's VCHG Pin while SIM900D is in POWER DOWN mode. IMPORTANT: Here Charge-only mode is charging when power down, it means that not all software tasks are running.	● Battery can be charged when GSM engine is not registered to GSM network; ● Only a few AT commands is available, as listed below.

Note: VBAT can not provide more than 5mA current while SIM900D module is during the DDLO charge state. In other words it is strongly recommended that VBAT should not be the main power supply in the application subsystem if SIM900D DDLO charging state occurs.

Table 8: AT Command usually used in Charge-only mode

AT command	Function
AT+CCLK	Set data and time of RTC
AT+CPOWD	Power down
AT+CBC	Indicated charge state and voltage
AT+CFUN	Start or close the protocol Set AT command **"AT+CFUN =1"**, module

	can be transferred from Charge-only mode to Charging in normal mode. In Charge-only mode, the default value is 0.

4.4.5 Charger requirements

Following is the requirements of charger for SIM900D.

- Simple transformer power plug
- Output voltage: 5.0V-6V
- Minimum supply current: 750mA
- A 10V peak voltage is allowed for maximum 1ms when charging current is switched off.
- A 1.6A peak current is allowed for maximum 1ms when charging current is switched on

4.5 RTC Backup

Current input for RTC when the VBAT is not supplied for the system. Current output for backup battery when the VBAT power supply is in present and the backup battery is in low voltage state. The RTC power supply of module can be provided by an external capacitor or a battery (non-chargeable or rechargeable) through the VRTC. The following figures show various reference circuits for RTC back up.

- **External capacitor backup**

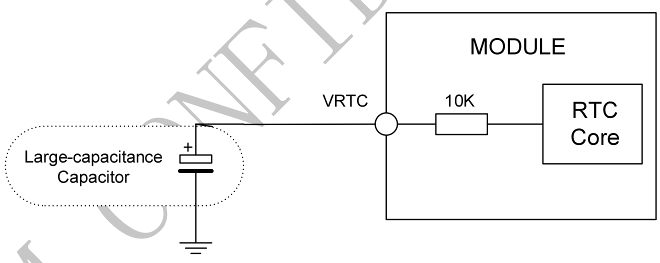


Figure 17: RTC supply from capacitor

- **Non-chargeable battery backup**

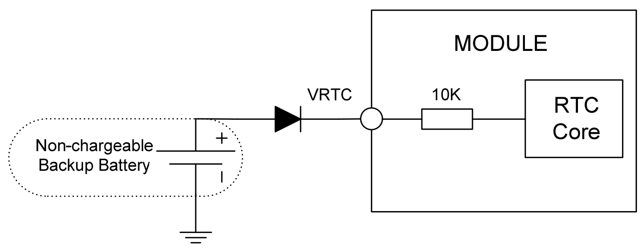


Figure 18: RTC supply from non-chargeable battery

- **Rechargeable battery backup**

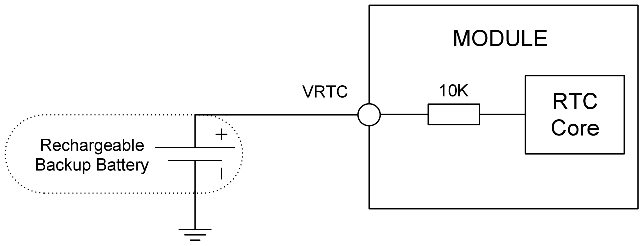


Figure 19: RTC supply from rechargeable battery

Coin-type rechargeable battery is recommended, such as XH414H-IV01E form Seiko can be used. Typical charge-discharge curves for this battery are shown in the following figure.

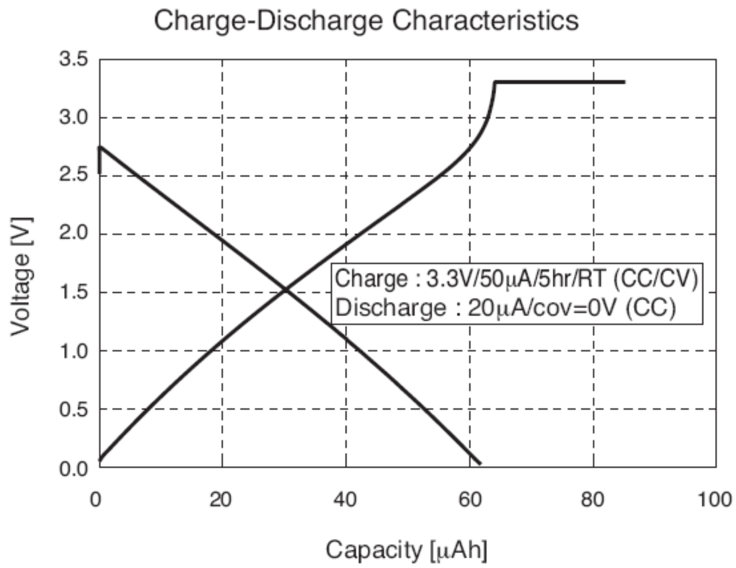


Figure 20: Seiko XH414H-IV01E Charge-Discharge Characteristic

4.6 Serial Interfaces

SIM900D provides two unbalanced asynchronous serial ports. One is the serial port and the other is the debug port. The module is designed as a DCE (Data Communication Equipment). The following figure shows the connection between module and client (DTE).

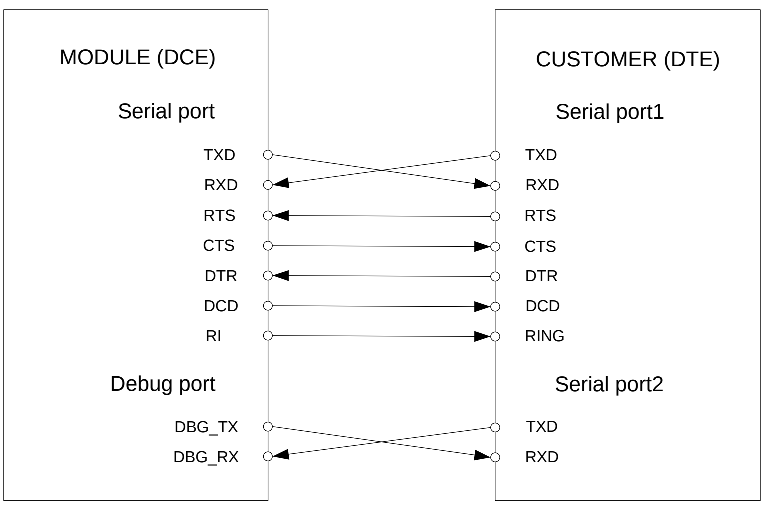


Figure 21: Connection of the serial interfaces

If only RXD and TXD are used in user's application, other serial pins should be kept open. Please refer to following figure.

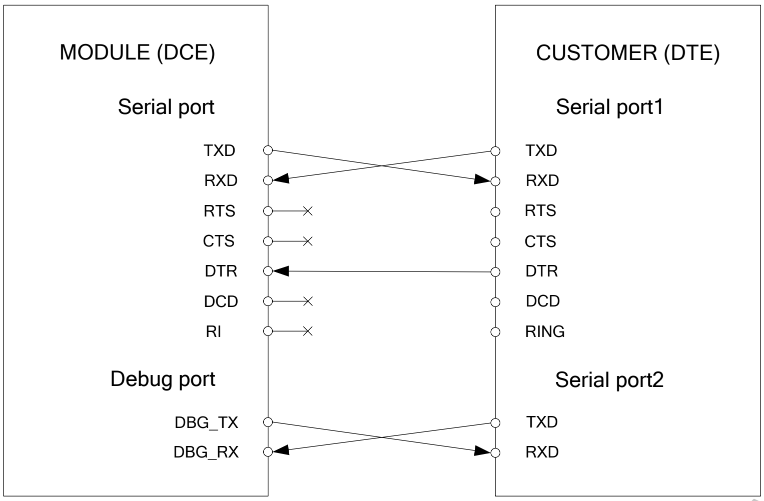


Figure 22: Connection of RXD and TXD only

Note: if sleep mode is need in this situation, the user need to connect the DTR signal as well, or only sleep mode2 can be used. For details, please refer to document [7].

4.6.1 Function of Serial Port and Debug Port

Serial port:

- Full modem device.
- Contains data lines TXD and RXD, hardware flow control lines RTS and CTS, status lines DTR, DCD and RI.
- Serial port can be used for CSD FAX, GPRS service and AT communication. It can also be used for multiplexing function. For details about multiplexing function, please refer to *document [7]*.
- Serial port supports the following baud rates:
  1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200bps
- Autobauding only supports the following baud rates:
  1200, 2400, 4800, 9600, 19200, 38400 and 57600bps
- The default setting is autobauding.

Autobauding allows SIM900D to automatically detect the baud rate of the host device. Pay more attention to the following requirements:

- **Synchronization between DTE and DCE:**
  When DCE powers on with autobauding enabled, user must firstly send character "A" to synchronize the baud rate. It is recommended to send "AT" until DTE receives the "OK" response, which means DTE and DCE are correctly synchronized. For more information please refer to the AT command "AT+IPR".
- **Restrictions of autobauding operation:**
  The DTE serial port must be set at 8 data bits, no parity and 1 stop bit.
  The URC such as "RDY", "+CFUN: 1" and "+CPIN: READY" will not be reported.

Note: User can use AT command "AT+IPR=x" to set a fixed baud rate and the setting will be saved to non-volatile flash memory automatically. After the configuration is set as fixed baud rate, the URC such as "RDY", "+CFUN: 1" and "+CPIN: READY" will be reported when SIM900D is powered on.

Debug port:

- Used for debugging and upgrading firmware.
- Debug port supports the baud rate of 115200bps.

4.6.2 Software Upgrade and Debug

Refer to the following figure for debugging and upgrading software.

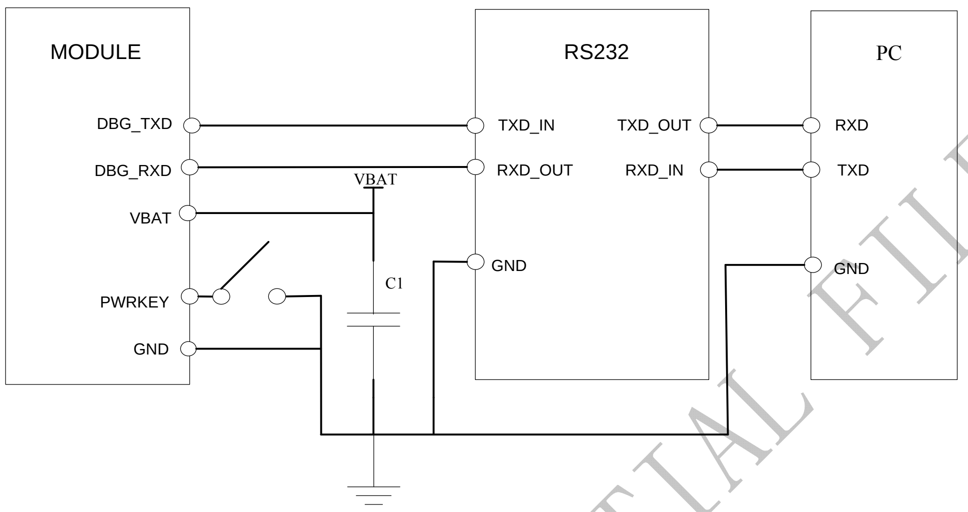


Figure 23: Connection for software upgrading and debugging

The serial port and the debug port support the CMOS level. If user connects the module to the computer, the level shifter should be added between the DCE and DTE.
For details about software upgrading, please refer to *document [4]*.

4.7 Audio Interfaces

SIM900D provides two analog inputs, MIC1P/1N and MIC2P/2N, which could be used for electret microphone. The module also provides two analog outputs, SPK1P/1N and SPK2P/2N. The output can directly drive 32Ω receiver.

AT command "AT+CMIC" is used to adjust the input gain level of microphone. AT command "AT+SIDET" is used to set the side-tone level. In addition, AT command "AT+CLVL" is used to adjust the output gain level. For more details, please refer to *document [1]* and *document [5]*.

In order to improve audio performance, the following reference circuits are recommended. The audio signals have to be layout according to differential signal layout rules as shown in following figures. If user needs to use an amplifier circuit for audio, National Semiconductor Company's LM4890 is recommended.

4.7.1 Speaker Interface Configuration

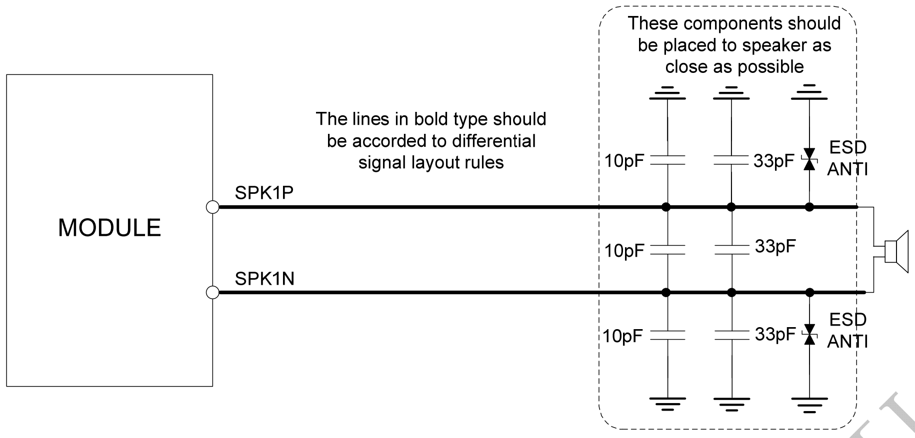


Figure 24: Speaker reference circuit

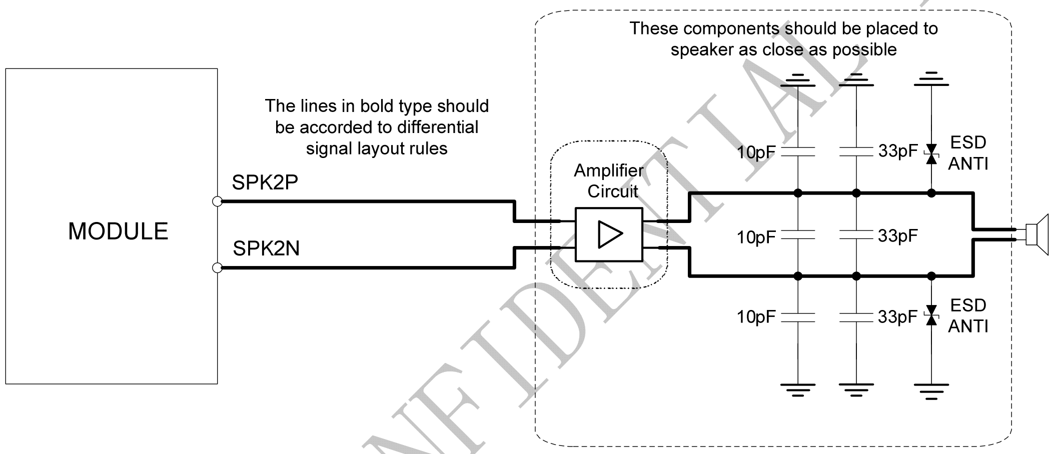


Figure 25: Speaker with amplifier reference circuit

4.7.2 Microphone Interfaces Configuration

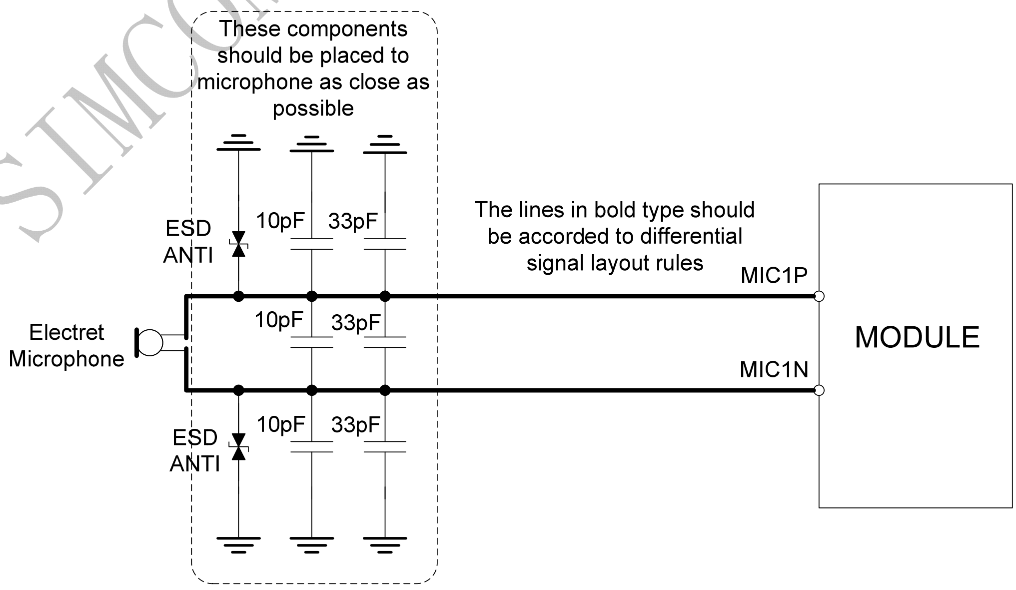


Figure 26 : Microphone reference circuit

4.7.3 Earphone Interface Configuration

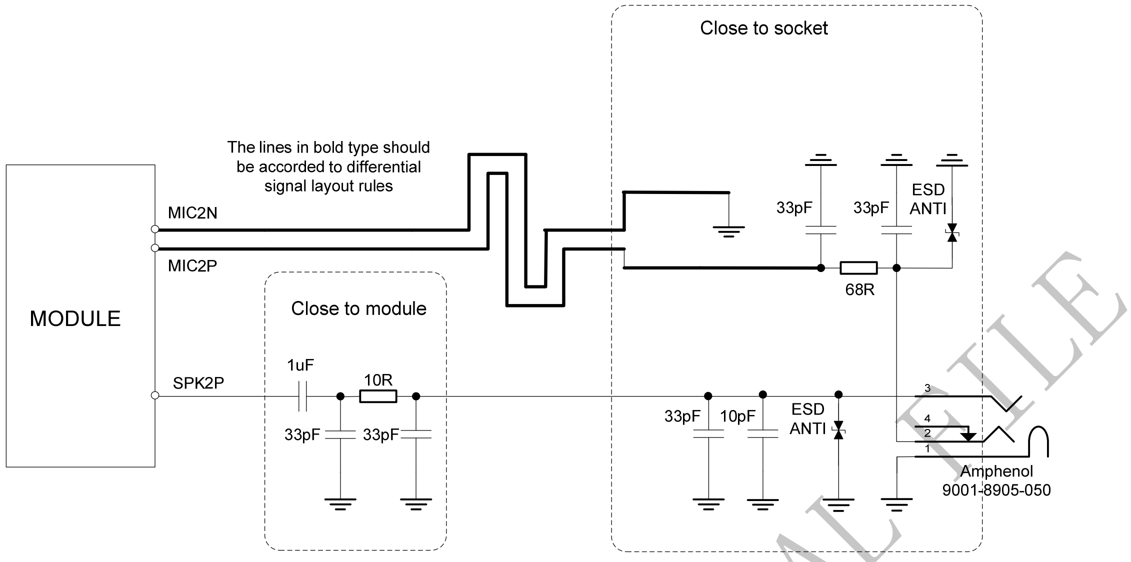


Figure 27: Earphone reference circuit

4.7.4 Audio Electronic Characteristics

Table 9: Microphone Input Characteristics

Parameter		Min	Typ	Max	Unit
Working Voltage		1.2	1.5	2.0	V
Working Current		200		500	uA
External Microphone Load Resistance		1.2	2.2		kΩ
Internal biasing DC Characteristics				2.5	V
Differential input voltage	THD <1% at F=1KHz; pre-amp gain = 20 dB; PGA gain = 14 dB		15.9		mVrms
	THD <5% at F=1KHz;pre-amp gain = 0 dB; PGA gain = 0 dB		740		mVrms

Table 10: Audio Output Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Normal Output(SPK)	RL=32Ω THD=0.1%	-	91	-	mW
	RL=32Ω THD=1%	-	96	-	mW
	Output swing Voltage (single ended)			1.1	Vpp
	Output swing Voltage (differential)			2.2	Vpp

4.8 SIM Card Interface

4.8.1 SIM Card Application

The SIM interface complies with the GSM Phase 1 specification and the new GSM Phase 2+ specification for FAST 64 kbps SIM card. Both 1.8V and 3.0V SIM card are supported. The SIM interface is powered from an internal regulator in the module.

It is recommended to use an ESD protection component such as ST (www.st.com) ESDA6V1W5 or ON SEMI (www.onsemi.com) SMF05C.The pull up resistor (15KΩ) on the SIM_DATA line is already added in the module internal. Note that the SIM peripheral circuit should be close to the SIM card socket. The reference circuit of the 8-pin SIM card holder is illustrated in the following figure.

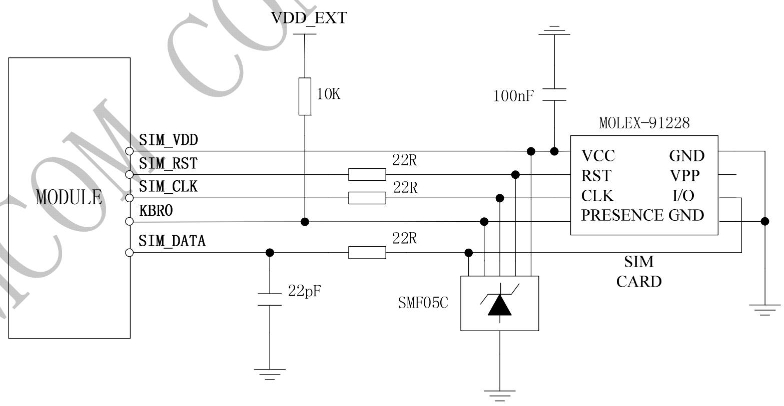


Figure 28: Reference circuit of the 8-pin SIM card holder

The SIM_PRESENCE pin is used for detection of the SIM card hot plug in. User can select the 8-pin SIM card holder to implement SIM card detection function. AT command "AT+CSDT" is used to enable or disable SIM card detection function. For details of this AT command, please refer to *document [1]*.

If the SIM card detection function is not used, user can keep the SIM_PRESENCE pin open. The reference circuit of 6-pin SIM card holder is illustrated in the following figure.

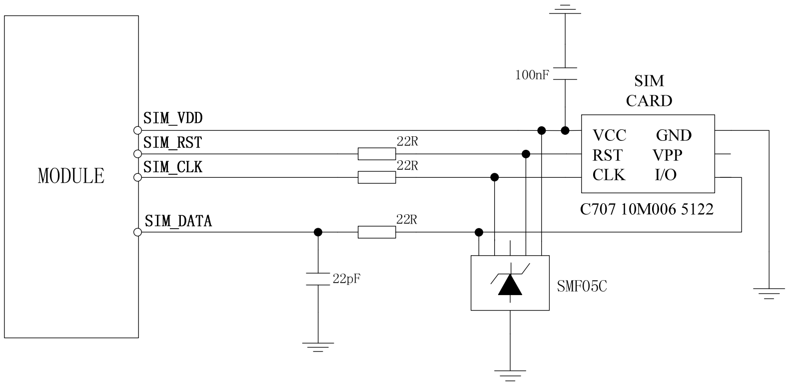


Figure 29: Reference circuit of the 6-pin SIM card holder

4.8.2 Design Considerations for SIM Card Holder

For 6-pin SIM card holder, SIMCom recommends to use Amphenol C707 10M006 5122 .User can visit http://www.amphenol.com for more information about the holder.

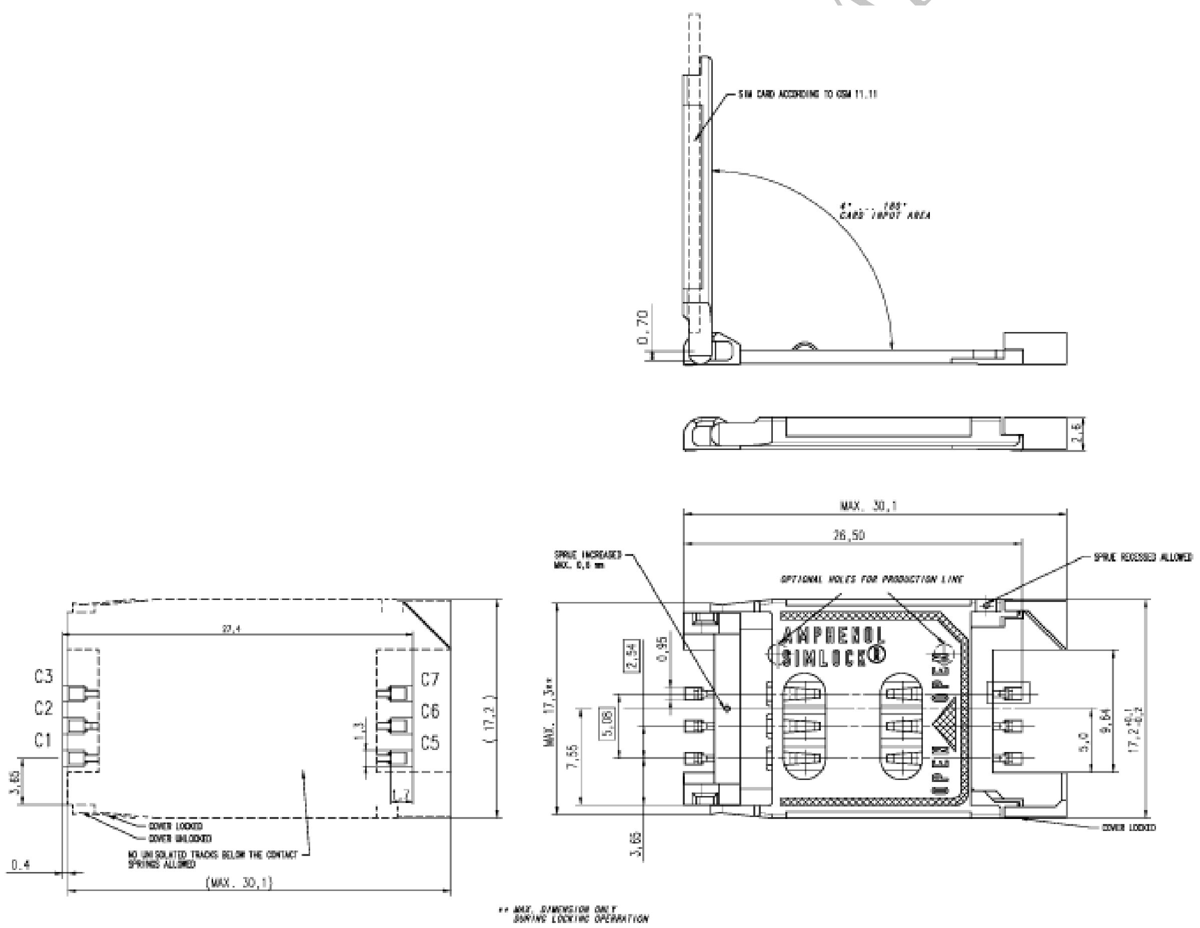


Figure 30: Amphenol C707 10M006 5122 SIM card holder

Table 11: Pin description (Amphenol SIM card holder)

Pin name	Signal	Description
C1	SIM_VDD	SIM card power supply
C2	SIM_RST	SIM card reset
C3	SIM_CLK	SIM card clock
C5	GND	Connect to GND
C6	VPP	Not connect
C7	SIM_DATA	SIM card data I/O

For 8 pins SIM card holder, SIMCom recommends to use Molex 91228.User can visit http://www.molex.com for more information about the holder.

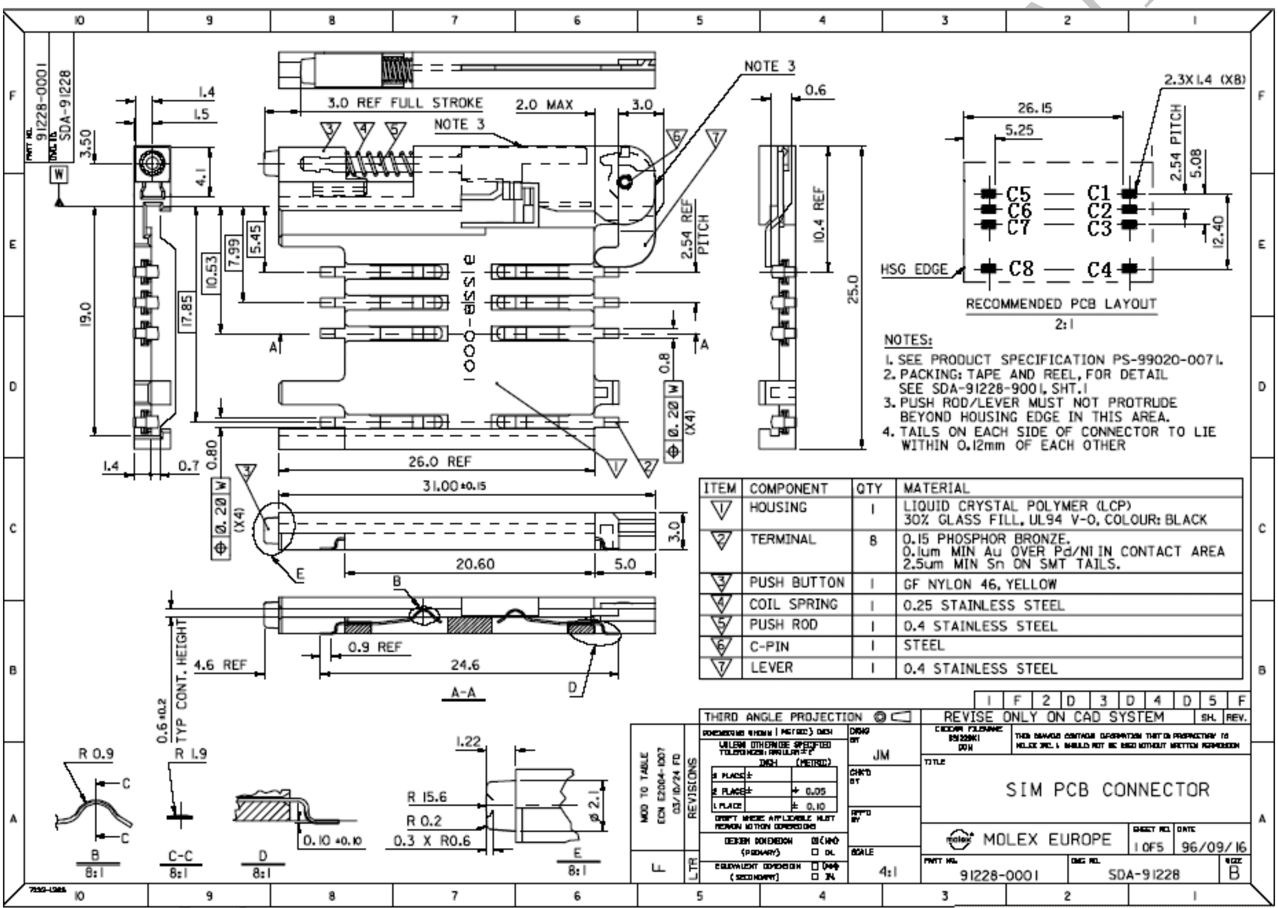


Figure 31: Molex 91228 SIM card holder

Table 12: Pin description (Molex SIM card holder)

Pin name	Signal	Description
C1	SIM_VDD	SIM card power supply
C2	SIM_RST	SIM card reset
C3	SIM_CLK	SIM card clock
C4	GND	Connect to GND

C5	GND	Connect to GND
C6	VPP	Not connect
C7	SIM_DATA	SIM card data I/O
C8	SIM_PRESENCE	Detect SIM card presence

4.9 LCD Display/SPI Interface

SIM900D provides a serial LCD display interface. It could also be used as SPI interface in the embedded AT application. For details about embedded AT application, please refer to *document [6]*.

Note: This function is not supported in the standard firmware. If user wants this function, the firmware must be customized. Please contact SIMCom for more details.

4.10 ADC

SIM900D provides an auxiliary ADC, which can be used to measure the voltage. User can use AT command "AT+CADC" to read the voltage value. For details of this AT command, please refer to *document [1]*.

Table 13: ADC specification

Parameter	Min	Typ	Max	Unit
Voltage range	0	-	2.8	V
ADC Resolution	-	10	-	bits
Sampling rate	-	-	200K	Hz

4.11 RI Behaviors

Table 14: RI Behaviors

State	RI response
Standby	High
Voice call	The pin is changed to low. When any of the following events occur, the pin will be changed to high: （1）Establish the call （2）Hang up the call
Data call	The pin is changed to low. When any of the following events occur, the pin will be changed to high: （1）Establish the call （2）Hang up the call
SMS	The pin is changed to low, and kept low for 120ms when a SMS is received. Then it is changed to high.
URC	The pin is changed to low, and kept low for 120ms when some URCs are reported. Then it is changed to high. For more details, please refer to *document [7]*.

The behavior of the RI pin is shown in the following figure when the module is used as a receiver.

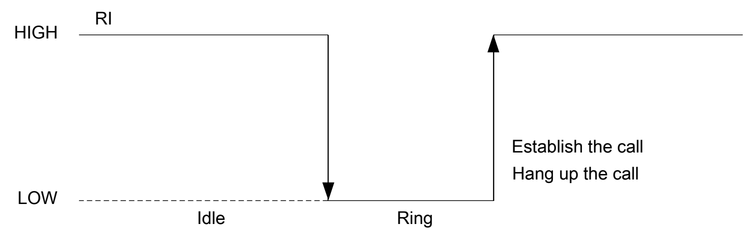


Figure 32: RI behaviour of voice calling as a receiver

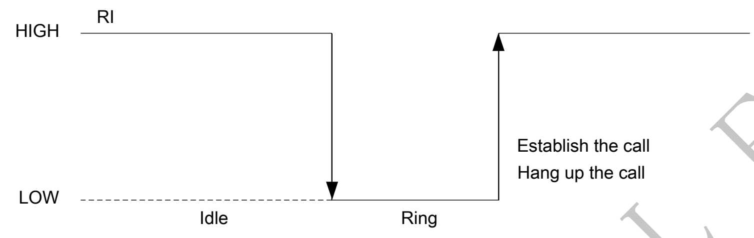


Figure 33: RI behaviour of data calling as a receiver

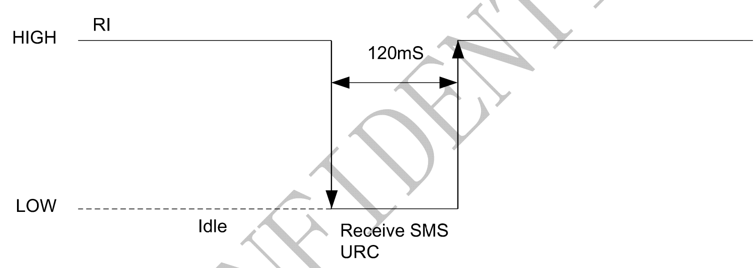


Figure 34: RI behaviour of URC or receive SMS

However, if the module is used as caller, the RI will remain high. Please refer to the following figure.

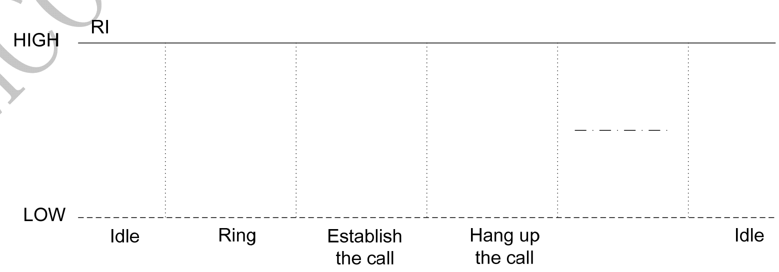


Figure 35: RI behaviour as a caller

4.12 Network Status Indication

The NETLIGHT pin can be used to drive a network status indication LED. The status of this pin is listed in following table:

Table 15: Status of the NETLIGHT pin

Status	SIM900D behavior
Off	SIM900D is not running
64ms On/ 800ms Off	SIM900D not registered the network
64ms On/ 3000ms Off	SIM900D registered to the network
64ms On/ 300ms Off	GPRS communication is established

A reference circuit is recommended in the following figure:

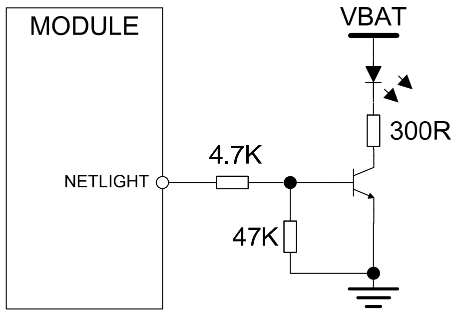


Figure 36: Reference circuit of NETLIGHT

4.13 General Purpose Input/Output (GPIO)

SIM900D provides 2 GPIO pins. The output voltage level of the GPIO can be set by the AT command “AT+ SGPIO”. The input voltage level of the GPIO can also be read by the AT command “AT+ SGPIO”. For more details, please refer to *document [1]*.

Table 16: Pin definition of the GPIO interface

Pin name	Pin number	Default function	Second function	Default state
GPO1	40	GPIO1		Output, pull down
KBR0	10	GPIO2	SIM card detection	Output, pull down

4.14 PWM

SIM900D provides one PWM which can be used to control a buzzer.

Features of buzzer PWM:

- 10-bit resolution for buzzer tone frequency generation from 200 Hz to 5 kHz
- Tone frequency error < 1 % for all standard piano notes from 200 Hz to 5 kHz
- Tone level control from 0 dB down to −24 dB in +4 dB steps
- Audio mute

The PWM for the buzzer outputs a square wave at the desired tone frequency. The tone frequencies are programmable from 200 Hz to 5 kHz and can be re-programmed on-the-fly to generate monophonic audio ring tones or alert tones. The tone level can be adjusted over a 24 dB range in 4 dB steps, or it can be muted

For details, please refer to document[1]

4.15 Antenna Interface

SIM900D provides a RF antenna interface. The customer's antenna should be located in the customer's main board and connect to module's antenna pad through microstrip line or other type RF trace which impendence must be controlled in 50Ω. To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.

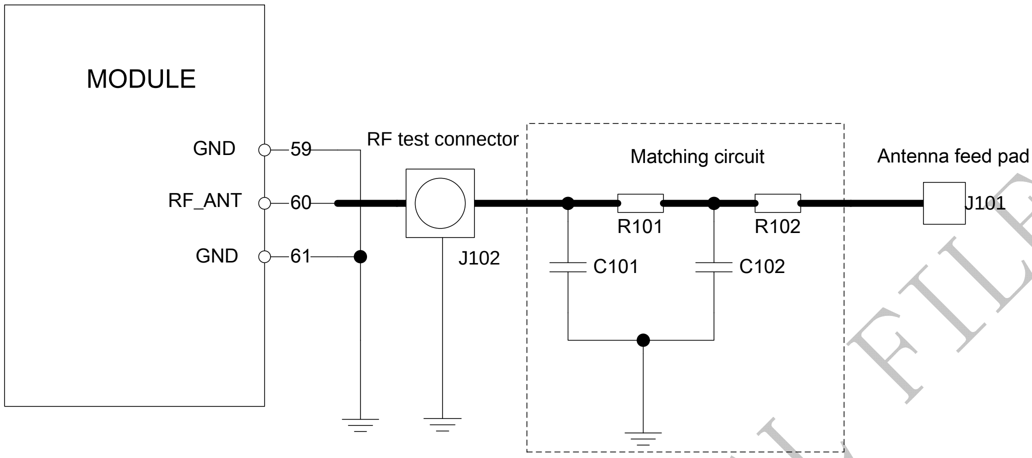


Figure 37: Antenna matching circuit

In this figure, the components R101,R102,C101 and C102 is used for antenna matching, the components' value only can be got after the antenna tuning. Usually, matching components' value is provided by antenna vendor, the default value of R101 and R102 are 0Ω, and reserve the place of C101 and C102 without soldering.

The RF test connector in above figure is used for conducted RF performance test, and should be placed as close as possible to the module's RF_ANT pin. The traces in bold type should be treated as 50Ω impedance controlled line in PCB layout. For details about radio frequency trace layout, please refer to *document [8]*.

5 Electrical, Reliability and Radio Characteristics

5.1 Absolute Maximum Ratings

The absolute maximum ratings stated in following table are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to SIM900D.

Table 17: Absolute maximum ratings

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	-	-	5.5	V
V_I^*	Input voltage	-0.3	-	3.1	V
I_I^*	Input current	-	-	10	mA
I_O^*	Output current	-	-	10	mA

*These parameters are for digital interface pins, such as GPIO, UART, LCD, PWM and DEBUG.

5.2 Recommended Operating Conditions

Table 18: Recommended operating conditions

Symbol	Parameter	Min	Typ	Max	Unit
VBAT	Power supply voltage	3.2	4.0	4.8	V
T_{OPER}	Operating temperature	-40	+25	+85	℃
T_{STG}	Storage temperature	-45		+90	℃

5.3 Digital Interface Characteristics

Table 19: Digital interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-10	-	10	uA
I_{IL}	Low-level input current	-10	-	10	uA
V_{IH}	High-level input voltage	2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.4	V
V_{OH}	High-level output voltage	2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.1	V

* These parameters are for digital interface pins, such as GPIO,, UART, LCD, PWM and DEBUG.

5.4 SIM Card Interface Characteristics

Table 20: SIM card interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
I_{IH}	High-level input current	-10	-	10	uA
I_{IL}	Low-level input current	-10	-	10	uA
V_{IH}	High-level input voltage	1.4	-	-	V
		2.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.4	V
				2.4	V
V_{OH}	High-level output voltage	1.7	-	-	V
		2.7	-	-	V
V_{OL}	Low-level output voltage	-	-	0.1	V
		-	-	0.1	V

5.5 SIM_VDD Characteristics

Table 21: SIM_VDD characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_O	Output voltage	2.75	2.9	3.00	V
		1.65	1.80	1.95	
I_O	Output current	-	-	10	mA

5.6 VRTC Characteristics

Table 22: VRTC characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{RTC-IN}	VRTC input voltage	2.00	3.00	3.15	V
I_{RTC-IN}	VRTC input current	-	2	-	uA
$V_{RTC-OUT}$	VRTC output voltage	-	3.00	-	V
$I_{RTC-OUT}$	VRTC output current	-	10	-	uA

5.7 Current Consumption (VBAT = 3.8V)

Table 23: Current consumption

Symbol	Parameter	Conditions		Value	Unit
I_{VRTC}	VRTC current	VBAT disconnects. Backup battery is 3 V		2	uA
I_{VBAT}	VBAT current	Power down mode		30	uA
		Sleep mode	BS-PA-MFRMS=9	1.0	mA

			BS-PA-MFRMS=5		1.2	
			BS-PA-MFRMS=2		1.5	
		Idle mode	GSM 850		22	mA
			EGSM 900			
			DCS 1800			
			PCS 1900			
		Voice call	GSM 850 EGSM 900	PCL=5	250	mA
				PCL=12	110	
				PCL=19	80	
			DCS 1800 PCS 1900	PCL=0	175	
				PCL=7	95	
				PCL=15	75	
		Data mode GPRS(1Rx,1Tx)	GSM 850 EGSM 900	PCL=5	240	mA
				PCL=12	110	
				PCL=19	88	
			DCS 1800 PCS 1900	PCL=0	170	mA
				PCL=7	88	
				PCL=15	80	
		Data mode GPRS(4Rx,1Tx)	GSM 850 EGSM 900	PCL=5	270	mA
				PCL=12	155	
				PCL=19	125	
			DCS 1800 PCS 1900	PCL=0	205	mA
				PCL=7	126	
				PCL=15	119	
		Data mode GPRS(3Rx,2Tx)	GSM 850 EGSM 900	PCL=5	450	mA
				PCL=12	202	
				PCL=19	143	
			DCS 1800 PCS 1900	PCL=0	300	mA
				PCL=7	139	
				PCL=15	126	
$I_{VBAT-peak}$	Peak current	During Tx burst			2	A

* In above table the current consumption value is the typical one of the module tested in laboratory. In the mass production stage, there may be differences among each individual.

5.8 Electro-Static Discharge

SIM900D is an ESD sensitive component, so more attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

Table 24: The ESD characteristics (Temperature: 25℃, Humidity: 45 %)

Pin	Contact discharge	Air discharge
VBAT	±5KV	±10KV

GND	±5KV	±10KV
RXD, TXD	±2KV	±8KV
Antenna port	±5KV	±10KV
SPK1P/ SPK1N SPK2P/ SPK2N MIC1P/ MIC1N MIC2P/ MIC2N	±3KV	±8KV
PWRKEY	±2KV	±8KV

5.9 Radio Characteristics

5.9.1 Module RF Output Power

The following table shows the module conducted output power, it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 25: SIM900D GSM 900 and GSM 850 conducted RF output power

GSM 900 and EGSM 850			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
0-2	39	±2	±2.5
3	37	±3	±4
4	35	±3	±4
5	33	±3	±4
6	31	±3	±4
7	29	±3	±4
8	27	±3	±4
9	25	±3	±4
10	23	±3	±4
11	21	±3	±4
12	19	±3	±4
13	17	±3	±4
14	15	±3	±4
15	13	±3	±4
16	11	±5	±6
17	9	±5	±6
18	7	±5	±6
19-31	5	±5	±6

Table 26: SIM900D DCS 1800 and PCS 1900 conducted RF output power

DCS 1800 and PCS 1900			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
29	36	±2	±2.5
30	34	±3	±4
31	32	±3	±4
0	30	±3	±4
1	28	±3	±4
2	26	±3	±4
3	24	±3	±4
4	22	±3	±4
5	20	±3	±4
6	18	±3	±4
7	16	±3	±4
8	14	±3	±4
9	12	±4	±5
10	10	±4	±5
11	8	±4	±5
12	6	±4	±5
13	4	±4	±5
14	2	±5	±6
15-28	0	±5	±6

For the module's output power, the following is should be noted:

At GSM900 and GSM850 band, the module is a class 4 device, so the module's output power should not exceed 33dBm, and at the maximum power level, the output power tolerance should not exceed +/-2dB under normal condition and +/-2.5dB under extreme condition.

At DCS1800 and PCS1900 band, the module is a class 1 device, so the module's output power should not exceed 30dBm, and at the maximum power level, the output power tolerance should not exceed +/-2dB under normal condition and +/-2.5dB under extreme condition.

5.9.2 Module RF Receive Sensitivity

The following table shows the module's conducted receive sensitivity, it is tested under static condition.

Table 27: SIM900D conducted RF receive sensitivity

Frequency	Receive sensitivity（Typical）	Receive sensitivity(Max)
GSM850	-109dBm	-107dBm
EGSM900	-109dBm	-107dBm
DCS1800	-109dBm	-107dBm
PCS1900	-109dBm	-107dBm

5.9.3 Module Operating Frequencies

The following table shows the module’s operating frequency range; it is followed by the 3GPP TS 05.05 technical specification requirement.

Table 28: SIM900D operating frequencies

Frequency	Receive	Transmit
GSM850	869 ~ 894MHz	824 ~ 849 MHz
EGSM900	925 ~ 960MHz	880 ~ 915MHz
DCS1800	1805 ~ 1880MHz	1710 ~ 1785MHz
PCS1900	1930 ~ 1990MHz	1850 ~ 1910MHz

6 Manufacturing

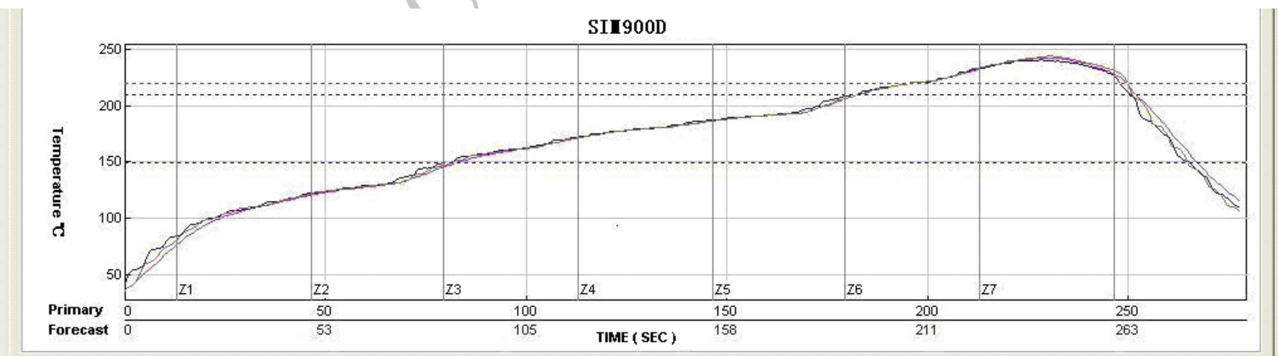
6.1 Top and Bottom View of SIM900D



Figure 38: Top and bottom view of SIM900D

These test points are only used for module manufacturing and testing. They are not for customer using.

6.2 Typical Solder Reflow Profile



TCs	RAMP		SOAP Between 150 to 210 ℃		Reflow 220℃		Peak Temperature ℃	
2	1.4	-7%	99.4	31%	53.8	38%	243.1	62%
3	1.4	-4%	100.5	35%	51.5	15%	241.0	20%
4	1.4	-5%	101.4	38%	54.4	44%	244.7	93%
Different in Temp	0.04		1.99		2.92		3.65	
P.2	1.4	-7%	99.4	31%	53.8	38%	243.1	62%
P.3	1.4	-4%	100.5	35%	51.5	15%	241.0	20%
P.4	1.4	-5%	101.4	38%	54.4	44%	244.7	93%
Different in Temp	0.04		1.99		2.92		3.65	

Figure 39: Typical Solder Reflow Profile

For details about secondary SMT, please refer to *document [9]*.

Appendix

A. Related Documents

Table 29: Related documents

SN	Document name	Remark
[1]	SIM900_AT Command Manual	SIM900 AT Command Manual
[2]	AN_SIM900_TCPIP	TCP/IP Applications User Manual
[3]	SIM900_Multiplexer User Manual_Application Note	SIM900 Multiplexer User Manual Application Note
[4]	AN_SIM900 Series_Update Tool_UGD	SIM900 Series Update Tool User Guide
[5]	AN_SIM900_AUDIO	Applications Note About SIM900 Audio
[6]	SIM900_Embedded AT Application Note	SIM900 Embedded AT Application Note
[7]	AN_Serial Port	Application Note About Serial Port
[8]	AN_SIM900D-TE PCB Layout & Schematic for Reference	Application Note About SIM900D-TE PCB Layout & Schematic
[9]	Module secondary-SMT-UGD	Module secondary SMT User Guide
[10]	ITU-T Draft new recommendation V.25ter:	Serial asynchronous automatic dialing and control
[11]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[12]	GSM 07.10:	Support GSM 07.10 multiplexing protocol
[13]	GSM 07.05:	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[14]	GSM 11.14:	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[15]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[16]	GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[17]	GSM 11.10	Digital cellular telecommunications system (Phase 2)； Mobile Station (MS) conformance specification； Part 1: Conformance specification

B. Terms and Abbreviations

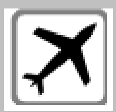
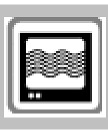
Table 30: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
IMEI	International Mobile Equipment Identity
Li-ion	Lithium-Ion
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
RX	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter

URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
Phonebook abbreviations	
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook
NC	Not connect

C. Safety Caution

Table 31: Safety caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive to not operate normally for RF energy interference.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forget to think much of these instructions may lead to the flight safety or offend against local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, for example no mobile fee or a invalid SIM card. While you are in this condition and need emergent help, please remember using emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

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